WHAT IS CLAIMED IS:

1. A detection system for use during irradiation of an interaction region of a structure with laser light, the structure comprising embedded material, the detection system comprising:

a collimating lens positioned to receive light emitted from the interaction region;

an optical fiber optically coupled to the collimating lens to receive light from the collimating lens; and

a spectrometer optically coupled to the optical fiber to receive light from the optical fiber, the spectrometer adapted for analysis of the light for indications of the embedded material within the interaction region, the spectrometer comprising:

an input slit adapted to receive light from the optical fiber, the input slit having a width selected to provide sufficient light transmittance and sufficient resolution;

an optical grating adapted to receive light from the input slit and to separate the light into a spectrum of wavelengths;

a collection lens adapted to receive a selected range of wavelengths of the separated light from the optical grating; and

a light sensor adapted to receive the selected range of wavelengths and to generate a signal corresponding to an intensity of the received light.

2. The detection system of Claim 1, wherein the structure comprises concrete and the embedded material comprises rebar.

3. The detection system of Claim 1, wherein the width of the input slit is in a range between approximately 5 microns and approximately 200 microns.

4. The detection system of Claim 1, wherein the height of the input slit is approximately 1 millimeter.

5. The detection system of Claim 1, wherein the light sensor comprises a coupled-capacitance discharge camera system.

6. The detection system of Claim 1, further comprising at least one neutral density filter adapted to reduce the light received by the spectrometer.

7. The detection system of Claim 1, wherein the focusing lens is coaxial with the laser light impinging on the interaction region.

8. The detection system of Claim 1, wherein the focusing lens is off-axis with the laser light impinging on the interaction region.

9. The detection system of Claim 1, wherein the structure comprises concrete and the embedded material comprises rebar, and the detection system is adapted to analyze light in a spectral region having an upper cutoff wavelength of approximately 582 nanometers and a lower cutoff wavelength of approximately 600 nanometers.

10. The detection system of Claim 9, wherein the detection system is further adapted to analyze the spectral region by calculating a spectral ratio.

11. The detection system of Claim 10, wherein the spectral ratio being greater than or equal to one corresponds to rebar within the interaction region.

12. The detection system of Claim 1, wherein the detection system further comprises a computer system adapted to analyze spectroscopic data.

13. The detection system of Claim 12, wherein the computer system comprises a microprocessor, a memory subsystem, and a display.

14. The detection system of Claim 13, wherein the microprocessor and the memory subsystem are mounted in an enclosure.

15. A detection system for use during irradiation of an interaction region of a structure with laser light, the structure comprising embedded material, the detection system comprising:

means for collecting light emitted from the interaction region;

means for separating the collected light into a spectrum of wavelengths; and

means for analyzing at least a portion of the spectrum for indications of embedded material within the interaction region.

16. A method of detecting embedded material within a laser-irradiated interaction region of a structure comprising the embedded material, the method comprising:

collecting light from the interaction region;

separating the collected light into a spectrum of wavelengths; and

analyzing at least a portion of the spectrum for indications of the embedded material within the interaction region.